

# Claims

[c1] What is claimed is:

1.A method of forming a gate structure comprising:  
providing a substrate having at least a stacked gate, the stacked gate comprising a gate insulating layer, a polysilicon layer, a silicate layer, and a cap layer;  
depositing a sacrificial layer on the stacked gate;  
etching back the sacrificial layer to expose the cap layer and an upper portion of the silicate layer;  
removing a portion of the exposed silicate layer to form a recess;  
removing the sacrificial layer;  
filling a silicon nitride layer into the recess; and  
forming a spacer on walls of the stacked gate.

[c2] 2.The method of claim 1 wherein the cap layer is composed of silicon nitride.

[c3] 3.The method of claim 1 wherein the silicate layer is composed of silicon tungsten.

[c4] 4.The method of claim 1 wherein the recess is formed by an anisotropic etching process.

- [c5] 5.The method of claim 1 wherein steps of filling the silicon nitride layer into the recess further comprises:  
depositing a silicon nitride layer on the substrate to fill up the recess; and  
performing an etching process to remove silicon nitride layer outside the recess.
- [c6] 6.The method of claim 1 wherein steps of forming the spacer further comprises:  
depositing a spacer layer on the stacked gate; and  
performing an etching process to remove parts of the spacer layer for forming a spacer on walls of the stacked gate.
- [c7] 7.The method of claim 6 wherein the spacer layer is composed of silicon nitride.
- [c8] 8.A method of forming a gate structure comprising:  
providing a substrate having at least two stacked gates, each stacked gate comprising a gate insulating layer, a polysilicon layer, a silicate layer, and a cap layer;  
depositing a sacrificial layer on the substrate between the stacked gates;  
etching back the sacrificial layer to expose the cap layer and an upper portion of the silicate layer;  
removing a portion of the exposed silicate layer to form a recess;

removing the sacrificial layer;  
depositing a silicon nitride layer to fill up the recess; and  
removing parts of the silicon nitride layer for forming a  
spacer on walls of the stacked gate.

[c9] 9.The method of claim 8 after forming the spacer further  
comprising:

depositing a barrier layer on the substrate;  
depositing a borophosphosilicate glass (BPSG) layer on  
the barrier layer;  
performing a flow process for planarizing the BPSG layer;  
performing a chemical mechanical polishing (CMP) pro-  
cess for removing the BPSG layer over a top surface of  
the cap layer;  
depositing a dielectric layer on the cap layer and the  
BPSG layer; and  
removing parts of the dielectric layer, the BPSG layer, and  
the barrier layer to form a contact hole between the  
stacked gates.

[c10] 10.The method of claim 9 wherein the barrier layer is  
composed of silicon nitride.

[c11] 11.The method of claim 9 wherein the dielectric layer is  
composed of tetra-ethyl-ortho-silicate (TEOS).

[c12] 12.The method of claim 8 wherein the silicate layer is

composed of silicon tungsten.

[c13] 13.The method of claim 8 wherein the recess is formed by an anisotropic etching process.

[c14] 14.The method of claim 8 wherein cap layer is composed of silicon nitride.